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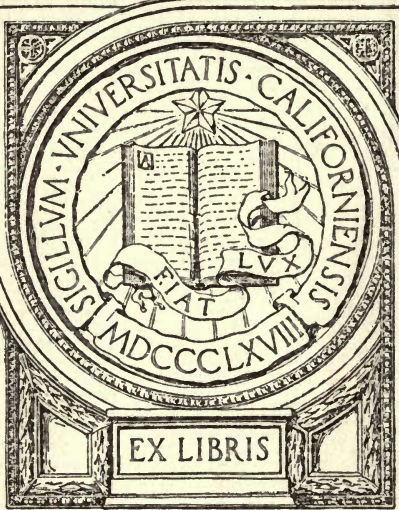
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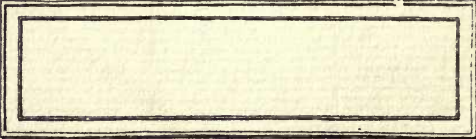
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# THE SOCIAL SIDE

OF

# THE ELECTRIC RAILWAY.

A PAPER,

BY

T. C. MARTIN,

Editor of THE ELECTRICAL ENGINEER, New York.

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# THE SOCIAL SIDE

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By T. C. MARTIN.

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A MONTH or two ago we had the pleasure of listening in this hall to a most interesting paper by Mr. S. Dana Greene on the development of electric traction. I had previously promised the secretary of the society a paper on the same subject, but I felt it would be useless for me to traverse the same ground again. Mr. Greene spoke with authority, and not as one of the newspaper scribes; and I was glad to learn from him and accept most of his conclusions. I recognize the fact, however, that he dealt with the topic mainly on its technical side, as a specialist of experience, and that there was still a very important branch of the subject on which a few helpful words might be said—namely, the relation of the electric railway to the public and to social conditions generally.

Few of us stop to think of the enormous difference that facilities for travel make in our lives. I do not refer to the opportunities and appliances for long journeys, but to the simple everyday transportation that we calmly accept as a prime condition of existence. It is probably safe to say that every one of us came here to-night, and will go home, without depending on our legs to make the trip. But this is altogether modern, and to the generation immediately preceding ours would have seemed as unlikely as that, from total lack of exercise our legs should become atrophied and own no function of pedestrianism. Yet now that we have enjoyed the advantages that the means of artificial locomotion already familiar give us, we want more. The Harlemiter does not consider it rapid transit unless he goes from City Hall square to the rocks and goats above Mount Morris park in an hour and a half, and his discontent with the steam railway on stilts becomes daily diviner and deeper. The citizen of Brooklyn is not satisfied to be reduced to a despairing calculation as to whether he is after all better off by being jammed and gouged on the bridge than by balancing on one trodden toe upon the old ferry boats, before he can reach his little vine-clad, mortgaged home at the back of the east wind. And as for the Jerseyman, it is needless to say that of all the ills of his wearisome daily travel, he is able to commute only one. Still, we are

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infinitely better off in choice of location for our homes than were the people of Manhattan before us, who knew not the elevated railroad, and never gladdened their eyes with the majestic spectacle of the platform of Brooklyn Bridge at a quarter to six on a wet March night, with the cable broken down. If you will take the trouble to invite the candid opinion of the "oldest inhabitant" as to the vanished Broadway stages, the early street cars, and the ancient ferries, you will learn that we have scored a distinct advance. That is why we all want something better.

This is a barbarous age we live in, but we have a foretaste of the civilization that awaits our descendants. We are beginning to learn that luxury is a relative term. A hundred or even 50 years ago there was no such thing as luxurious travel. Washington came to New York to be installed as president, in a manner that a fastidious drummer might now despise. De Quincey was willing to give five years of his life for an outside place on a stage coach that carried down from London through the English counties the news of a great event. We save our five years and our health, and get all the thrill we want, by blocking up the sidewalk on Park Row, and reading the newspaper bulletins as they cover one another on the boards, like successive waves of emotion, rolling in from the unseen but tangible throbbing distance. We know what the past was. The blizzard of two years ago brought us down to the normal, average conditions of semi-savagery in locomotion as it prevailed prior to the introduction of the steam road, conditions that need all the glamor of the romancist to be made even tolerable as a picture to the New Yorker who boards the Pullman special for the south, and has had his pleasure in Florida, and returned before the storm that was in progress when he left has gone eastward to discover Europe.

What steam has been to long-distance travel in replacing the stage coach and the sail, electricity is in turn to urban travel in replacing the horse car and the cable road. Later in this paper I will indicate the manner in which electricity may sooner or later realize the best and brightest promises made on behalf of the trans-continental steam railroad, but our first thought is as to electrical travel within towns and cities, and the manner in which it affects social relations, by modifying as with the harlequin wand of transformation all the conditions to which we have heretofore been subjected.

In speaking of this great advance in electricity as applied to the comfort and convenience of man, I do not wish to be understood as praising a perfect thing. We are in the early stages of practical electric locomotion. The pioneer work has been done by young men, still among us, much too near their salad days to fall into the reminiscent vein. It is barely three years ago that I had myself the honor of bringing before the American Institute of Electrical Engineers the first statistics published on American electrical railways, when I seized with brazen audacity upon every bit of a track that could possibly bear inclusion as a road. I would be understood rather as appearing in advocacy of an improvement in many respects crude, but that is not yet appreci-



ated even as it stands. We of the electrical industry have a great duty in this respect, of preaching the advantages of electric locomotion, in season and out of season; and by our persistency we can help the art along. The phrase that good wine needs no bush was not coined by an American advertiser, and the idea that electricity will make its own way is not justified by the history of any great invention that has yet subserved the needs of mankind. Electric locomotion is, however, ready for adoption at an opportune moment. It offers itself at a time when every thing else that has been tried for urban travel, has revealed objections and disadvantages, the more keenly realized because of our higher conceptions of what such travel may be. It is a singular principle that as a system or device reaches perfection something comes forward to supersede it. The horse coach was at its height of speed and comfort when the steam engine challenged it. The white-sailed China clipper was never swifter than when it lowered its flag to the conquering steamship. And so to-day, the horse, the cable and the steam locomotive have shown the utmost that they can do, just as the electric motor rolls to the front and takes the stage, as the means best suited to the peculiar requirements of passenger traffic in modern towns and cities. I do not say that it will banish these competitors from the scene, but I do maintain that its superiority will quickly gain it the decided preference. I am always suspicious of an invention or improvement that is going to knock out everything else, like a charge of dynamite. History is against any such phenomenon. What we do see is a limitation of the antecedent methods and appliances to the sphere within which they are most useful and economical. The old is restricted to its proper place and function as by a ring of fire; the new goes on making its own kingdom until at last its boundaries of achievement are also determined. Thus, as Tennyson puts it, "God fulfils himself in many ways, lest one good custom should corrupt the world."

The first of the social considerations to which I would direct notice is the effect on the public of the adoption of electricity as a motive power for street railways. The struggle for supremacy in urban passenger work has already narrowed down strictly to the horse, the cable and the electric motor. As everybody knows, steam motors are completely out of favor for use within city limits. Their glorious record of half a century in long-distance travel does not deceive anyone dwelling in a city as to the insuperable defects and nuisances of noise, smell, smoke, dust, steam escape, oil drippings, etc., which may more readily be tolerated, remotely, in the open country. Perhaps I am wrong, but I believe we shall not see any more steam roads in New York, and that imposing as are the statistics of the Manhattan elevated system to-day, they will be eclipsed in a very few years by those of the newer form of electric locomotion. And may not the same be said as to the horse? There are now close upon 15,000 horses engaged in hauling street cars around this city. It is high time that every one of these was dispensed with, as well for its own sake as for that of the city, whose air it assists in polluting and

whose population it aids in driving into exile. Allowing an average space of 40 square feet to each horse, or a stall 9 feet by  $4\frac{1}{2}$  feet, we find that in stall space alone those 15,000 horses occupy 600,000 square feet of floor in their stables. These horses are required to operate some 2,400 cars, an average of about seven to the car if every car were in commission at once, which is not at all the case. But even if nearly all the cars were wanted, an average of 10 h. p. each would be ample in the central station of an electrical plant, bringing us to a liberal allowance of 25,000 h. p. But here comes in the remarkable though not unfamiliar fact that a steam plant will go into much less space than an animal power plant of equal capacity. Mr. C. J. Field, who is known to many of you as a constructing and mechanical engineer, informs me that his recent practice shows that a generating electrical plant for 20,000 h. p., to operate all the street cars of this city, could easily be placed in a building 100 x 150. The engines and the dynamos would be placed on the first floor, and the boilers on the second floor. The generators in such a plant would be multipolar, 500 h. p. each, directly connected to the engines, and each engine would be of a vertical triple expansion type, of 500 h. p. each. This gives only  $1\frac{1}{2}$  square feet to the horse-power, and we may offset the space for feed, etc., by that for coal, etc. I have tested these figures by those of recent electric light stations in actual operation, and they are found to be very fair and reasonable. It might be objected that all the power would not be bunched in this way; but even with half a dozen generating stations of 2,000 h. p. there would only be an increase in space required of about ten per cent. From this remarkable but strictly proper comparison, we can form an idea as to the economy of real estate, bearing in mind also the fact that horse car stables are generally wooden or brick sheds, only one or two stories in height, while an electrical plant may be run up as high, as an apartment house or an office building, just as ornate without, just as clean within.

Hence there can be no mistake in the statement that electricity is a direct boon to the urban population that clings to the city, loves the city life, and that if crowded out from it into the country suffers all the pangs of banishment. Indirectly, too, it is a further boon because with horses a great portion of the district surrounding the car stables is also spoiled for human habitation. The whole region within what I would define as "the area of smell" is unsavory and unhealthy the year through, and the consequence is that while the taxing and renting value of it is lessened, the death rate is run up. "Do not insult a respectable animal who has come from the country to do his share of the work of the world," says one authority, "and has brought with him the memory of the sweet hills and skies at least, by immuring him in one of those cramped, rickety, rotten, slovenly, damp dungeons, where a dumb beast would lose his self-respect and his courage, beneath an oppressive weight of miasma, and hideous, gloomy, nasty confusion." And so say all of us, and all of us are glad to note a vast improvement in this respect. The stables are better



ventilated now as a rule, but the trouble is just there. If they were not so well ventilated, the neighborhood would be sweeter, and would be fitter for human beings to live in. The poor die quicker than the horses may suffer longer.

An objection I may anticipate is that, after all, such large generating plants would not be desirable with their huge smoke stacks, their discharge of gases, etc., upon the atmosphere, their receipt of coal and their removal of ashes. I would reply that it is by no means necessary for such plants to be, as the stables must be, right upon the main lines of travel. They would by decided preference be located near the water's edge, out of the way. Moreover, the stacks would be, as they are to-day in large electric light plants, high enough to carry off all smoke or smell far beyond perception. Perhaps the familiar smoke stack is not an æsthetic object, but it can be made so. There are steeples in this town that on the score of their beauty are not fit to compare with smoke stacks near them.

Much that I have said under this head with respect to electricity applies to the cable. That system has been an immense advance in street car travel, and is destined to many years of usefulness yet. It is worthy of much praise; but it will not hold its own with electricity, simply because it is deficient in some things that electricity possesses to a pre-eminent degree. It has been a forerunner for electricity. It is not only enormously costly in its first installation, but has the disadvantage of being a unit. The whole of the road and all its power hangs by that one cable. If the cable be duplicated in the conduit, the expense is again so much the heavier, while the criticism as to risk still stands. Moreover, a cable car cannot go backward at its driver's will. Onward it must go, Mazeppa-like, strapped down to its carrier, no matter what unfortunate contingency impend, or what obstacle lies in its path. It cannot greatly vary its own speed. An electric car is so manageable that it will reverse in its own length or less. But the greatest trouble of all with the cable is that it is always the one thing, while there are very few towns or cities that are alike in offering just the rigid Procrustean conditions it meets. There are about 50 cities in the United States with a population of over 50,000, but there are between 700 and 800 street railway companies, if not more; so that even if all the places in the first category could justify the heavy expenditure on a cable system, there are hundreds of others unable to do so. We need not wonder then that at their last convention in Minneapolis, the street railway men gave electricity such a hearty welcome, adopting the enthusiastic if not elegant language of a committee report which said that it "filled the bill to perfection." Nor need we wonder that the street railway company in Minneapolis has just thrown aside an unused cable plant that cost \$400,000, and is putting in electric cars and over 100 miles of electric road.

Why does electricity "fill the bill," and in a manner that interests the public? Well, for the reasons given already and for others. It is above all things flexible, plastic, protean. It can be applied in half a dozen different ways, and be absolutely safe for

human life in any and all of them. The street railway may be equipped with an overhead system for supplying the current to the motors, and to that system, well built, with trim ornamental poles, lines well run and guarded, little or no objection can be offered. The air is God's own insulation; we know none better, none so cheap, and a wire is well insulated up aloft. The Bostonians, who are people setting no small store by their refined, acute and cultivated taste, have adopted poles and wires in preference to the hideously ugly lattice work tunnels we have in New York to hold up our elevated roads, and I admire them for it. It is possible that Boston may have an elevated road, but if so it will be a handsome electric one. Or, if the overhead wire be objected to, as it may, there is the conduit system, which is fully able to give a good account of itself if well put in and plenty of money be spent on it. It is true that the wires are not exposed in the conduit system, but otherwise there is not much operative difference between it and the overhead method. There may be difficulties in heavy wet, or snowy weather, but we shall see them all overcome. Or should this or its modifications again be found fault with, there is the ideal storage battery system, where each car starts out "on its own hook," an independent, self-contained unit. I don't exactly know why we call it the "ideal system." It is either within reach or beyond. If within reach, it is not "ideal," but ought, speaking from the public standpoint, to be adopted wherever there is actual need for it. It may be a trifle expensive, but that is certainly not one reason more why the public should do without it. It may be somewhat difficult to put and keep in order. "Coaches, Sammy," said the elder Weller, sententiously, to his son, "coaches is like guns—they require to be loaded with werry great care afore they go off," and that is about the case with the storage battery cars. But they do go off, and we know from the approval they have met with that they do hit the mark of popular approval,—and that is one of the main things I am talking about to-night.

It is in one or other of these systems or modifications of them that electricity will become familiar to the public of this country in street railway work. It will, I think, be chiefly for a long time to come, the overhead system, which is not costly to put up, is not expensive to maintain, can be operated economically at about half the running charges of animal power, and fully answers the requirements of the vast majority of our thriving, intelligent centres of trade and manufacture. All these methods are safe, and none of us ever heard, or expects to hear, that the current of 500 volts they have employed has taken a single human life. The motor cars cannot "explode," the daily papers to the contrary notwithstanding. They scatter no dust or ashes; they do not litter the streets with offensive refuse, but rather ozonize the air; they are pleasant to ride in and they do not damage the paving. They require good tracks for their best operation, and naturally make their worst showing on the automatic mud sprinklers that so begutter the roadways in this city. But the roadbed between the tracks they never touch. It might as well be a continuous



plot of flowers. In the outskirts of Boston, some of the electric cars whose aerial wires run hidden between the overarching trees, have their tracks laid down on a narrow green lawn for three or four miles ; and at a remove of but a few feet, it seems to the spectator as though the cars were gracefully skimming over the smooth grass, in effortless flight, like low-darting, even-poised swallows.

I have just spoken of the outskirts of Boston, and this brings me to another important point wherein electric cars are an element making for the public good. They help a man to get farther away from his business, and yet bring him nearer to it. "Rapid transit" by their means is no longer a deceiving phrase, or the proud monopoly of one or two big cities. The smallest city in the country is at once given a command it never had before over the territory around it. The smallest store keeper or the humblest clerk can revel in the sweets of rural life, if he wish. His electric car, running at 15 or 20 miles an hour, will give him more of home life—a few golden minutes with the children in the morning, an earlier return to the wife at nightfall. The whole social atmosphere of the place is vivified, and the social bonds are knit closer, as they always must inevitably be where the facilities of travel are increased, and the opportunities of intercourse are multiplied.

Nor is this all. Rapid transit of this nature opens up a number of districts that before were practically inaccessible for residential purposes. There are few of us who care to practice the ancient form of dissipation known as early rising, agreeing rather with Charles Lamb, in the idea that to rise with the lark or go to bed with the sheep is a popular fallacy. There are still fewer of us, who, even for the sake of rural delights, care to isolate and immure ourselves in remote suburbs reached with difficulty. In vacation time, it is true, we often seek the loneliness of the woods, or the solitude of the mountains, that we may commune with Nature and hear the still small voice of our better self ; but when we are doing the world's work 50 weeks in the year, we want to be handily situated for reaching our desk or bench. If a man lives in the city, he pays a high rent and takes Irish views of the landlord question. If he lives far out, and wastes his time in travel, he is in hearty sympathy with the eight hour movement. I look upon electric roads, therefore, as likely to prove a beneficial agency in the more equal distribution of a happier population around any centre, thus increasing the return on outlying property, while, by the encouragement of retail trade, enhancing the profit of the area lying within the region thereafter more legitimately restricted to business occupancy. I have watched with much interest the manner in which electric roads have already thus developed suburban areas. Booms are not a particularly healthy feature of progress, but they may be, and not infrequently are, genuie and real ; and I know nothing more likely to bring on a real estate boom of the best character with permanent results than the installation of a well-managed electric road, enabling a man to leave his work at 6 o'clock, and be sitting down to his supper seven or ten miles out, if he wish, under his own roof-tree, at 6.30.



Having thus discussed the effect of electric roads on the community and on the individual citizen, I will add a word as to their effect on the wonderful impersonal entity, "capital." If all that I have said be true as to the general benefits, it follows that the wealth and ease of the community are materially increased; but what I refer to now, is not the direct enhancement of values, so hard to trace out, though so palpable, but the stimulus given to saving habits by the better opportunities of investment. Careful analysis of the working of electric roads goes to prove that when operated with skill and discretion, they are 50 per cent. less expensive to run than horse railroads are. What does this mean? One thing it means is that many roads can be built that would be out of the question with horses. Another is that roads not paying can be placed on a dividend basis. In 1888, out of 19 horse roads reporting in New York city, 10 showed a deficiency. Last year their net earnings were much better, but it is evident that a horse road is not always a mine of wealth, though it may be of fertilizers. A third point is the establishing of a new class of investments of a solid, enduring nature. It is within everybody's knowledge that the accumulation of capital tends constantly to the reduction of interest to a minimum. There was a time when the long stocking and the iron chest were the common bankers for the savings of the timid; and the capital that was bold earned the double reward of its bravery and scarcity. As Walter Bagehot, the economist, has remarked, the English people have always wanted to put their money into something safe that will yield five per cent.; and this is undoubtedly one reason why English capital, free and fluent, is so much a power in the finance of the world, and why so much comes this way. As Mr. Bagehot says:—"In most countries, most men are content to forego interest; but in more advanced countries at some times there are more savings seeking investment than there are known investments for." It is thus in America, so far as "safe" investments are concerned, and by safe I mean such as do not require the active care and ceaseless thought of the capitalist, but may be held by trustees, widows, hospitals, universities, savings banks and the like. The competition of capital for the best class of government bonds, municipal bonds, railroad stocks, &c., has reduced the return on these to a very low figure, whether in America or England or Germany; and the result is that we see to-day, as never before, the planning of enormous trusts and gigantic industrial enterprises, which represent in no small degree the endeavor of capital, or savings, still to enjoy its wonted income, but in newer fields. Now I look upon the street railway business of the country, under the regime of electricity, as offering one of the best opportunities for local capital, and for what may be called the organization of local savings, which might otherwise lie around in napkins, like the unjust steward's talent, and be of no use to anybody. The capital in street railways in America to-day, reaches from \$175,000,000 to \$200,000,000. If the statement I have made as to the superior economy of electrical power be true, how much greater becomes the earning capacity of this investment, and how much greater

are the attractions held out to construct the hundreds of new roads that are still wanted and will be called for as our towns and cities grow. Of course, I am aware that it may be said that this showing might lead to a demand for lower fares. It might, but the public is intelligent enough to know that other things are more necessary, such as better cars, with better heat and better light ; improved tracks, faster running time and shorter headway ; so that the 150,000,000 passengers on the street railroads every year may travel in all safety and comfort. Street railroads are peculiarly suitable as a field for local investment. Their operation can be watched all the time. They run under a man's eye when he is on the street, or past his window when he is home. He knows something of their officials ; he can influence the domestic legislation they are subject to ; he can assist in more ways than one to swell their earnings.

The next important point to which I would direct your attention is the effect that the electric railway has upon the employés of the service. It cannot be denied that the introduction of electricity in this respect marks a decided advance in the social condition and aptitudes of a large body of men. I have never yet met with anybody or anything that could place the work of a horse car driver in a favorable light. One certainly could not fairly expect a man who spends the day with his nose at the tail of a car horse to realize a very high ideal of life and duty, especially when the whole of his work is done under conditions exhausting alike to temper and physique. It is out-door exposure the whole time, whether in summer heat or winter blast. Half the time it is an exercise of sheer brute strength, and no car driver believes in his heart that a horse-power is only 33,000 foot pounds a minute. His aching wrists and dislocated shoulders tell him that Watt was far below the mark in putting it at that figure. And then, the worry of the street traffic. We have all of us noticed the conscientious persistence with which draymen and coachmen will keep on the car tracks in front of a car. An investigation made two or three years ago in Chicago showed that at one point in the streets there, 97.6 of the street traffic sought the railroad, while at another it was 87½, and at a third, 90 per cent. Against such odds the driver with his restless or apathetic team has to make his way and keep to the running schedule ; fighting all the time with the fear of an accident either to his car or to some hapless foot passenger.

With an electric car, the matter is not one of muscle and brawn, but of average intelligence and ordinary readiness of decision. A better class of men are wanted and forthcoming, or the same men are relieved from physical wear and tear, and thereafter can earn their bread in the sweat of their brow and not that of their body. A woman might easily run an electric car. The motorman gets instantaneously by the turn of a switch the exact degree of power that he wants ; he can apply his brakes readily ; and if he needs to run backward up-hill he can do so, sitting down at his switch. It is not necessary to expose him to the weather. His fears as to running people down are



materially lessened by the gain in control of the car and by the further fact that an electric car takes up only half the space on the street that a horse car and its team do. The work is not less safe than cleanly. You may remember that when steam roads were started in South Carolina, one of the negro drivers tied down the safety valve and then sat on it. As a result, cotton bales were placed between the locomotive and the coaches to protect the passengers in case of explosion. The new driver was, however, still on the wrong side of the bales. In electric cars both driver and passengers are free from harm. John Bright once said that the safest place on earth was a first-class carriage in an express train; but to-day it may be fairly affirmed that no vehicle can compare as to freedom from danger with the electric street car.

A feature of this refinement of the work is that it must necessarily be attended by better pay for the higher intelligence and skill. Mere brute strength does not command good wages nowadays, except in a prize fighter, and the further we get away from animal conditions the better do we find the status of the individual or the occupation to be. The remarks made above as regards the drivers apply equally to the staff at the generating plant. People sometimes wonder why there are so many hostlers around car stables, but when you remember that well-kept car horses work only two hours and a quarter daily, you will see that they need a good many attendants at the stables during the other 20 odd hours. In place of these grooms and hostlers you have, with an electric plant, a skilled force of steam engineers and mechanics, each trained for the special function which the principle of the division of labor has shown him to be best qualified for.

And here let me inject the pertinent remark, that this new and successful development of electricity is one reason more why the mechanical engineer and steam engineer should master electrical principles and practice, whether for the higher walks of his profession or for the humbler duties of running a plant. The coming of electricity, and its application to light and power, has afforded a grand stimulus to steam engineering in every department, and may not improperly be claimed to have created the modern high speed engine. Sir William Thomson has said that the electrical engineer is nine-tenths a mechanical engineer. To this I will add a corollary, and say that the mechanical engineer may be a master in these new electrical fields if he will only add the one-tenth to his education. The time is at hand when the mechanical engineer will not be considered worthy of his name or his calling unless he is also an electrical engineer, as familiar with Ohm's law as he is with Carnot's or Mariotte's.

Incidentally through this paper I have referred to the effect of the electric railroad upon horses. It has, indeed, been most gratifying to see how readily the electric railroad has rallied to the support of the Humane Society. It is a humane society itself. Whether he wished it or not, the electrical engineer in this instance is conferring a great boon on the horse. We sometimes do the greatest good, as we do often the greatest evil, uncon-



sciously, rather than of set purpose; and so, here, the inventors of the modern electric motor and the electric car have released the horse from one of the most painful and exhausting services that it was ever put to. Investigations over a long period have shown that with the pavement dry a horse would meet with an accident in every 78 miles of travel on granite; on every 168 miles with the pavement damp, and every 537 with the pavement thoroughly wet. Unfortunately for the horse, though happily for the rest of us, the first two conditions generally prevail on our streets; and hence the horse has a poor outlook as to accidents. But it is not the accident the horse has so much to dread, after all, as the constant strain and the pull of a heavy load from its dead rest every few hundred yards. It is generally admitted by street railway men that car horses fail because of this feature of their work, and that it helps to cut down their railroad life and utility to the average of from three to five years. If you want to see these conditions at their worst, take Broadway, once our pride, now one of the most overrated thoroughfares in Christendom. The pavement is abominable, and the horses, like the foot passengers, can be seen struggling for a grip on the uneven, slippery stones, all the way from one end of it to the other. The traffic on the street is so great that I have noted full cars making a dozen halts and starts from dead rest between Chambers and Barclay streets—two blocks. It does not require an expert to foresee the effect of such wear and tear on animals. In Cincinnati, recently, on installing an electric equipment, a street railway company advertised its horses for sale for family and carriage purposes. I have not observed any such advertisements in New York city. The street railway managers are more modest or more truthful here than they are on the banks of the Ohio. The only persons likely to regret seriously the departure of the street car horses from this city would be the horse dealers and feed supply houses, and possibly the street cleaning contractors, though they get their pay anyhow.

I might point out that as a further offset to this displacement of a certain amount of labor in an elementary form whether that of the horse or the human being in charge of him, we have the stimulus given to a higher class of labor, not only in the station engineer, and motor car driver, but in the electrical expert and inventor. Society benefits greatly by this, just as it does by the superior skill and efficiency implied in the maintenance of such a system as that of the Pennsylvania Railroad company. The running of express trains and fast steamships demands the exertion of the best qualities of a man, as well in the conception of ideas of improvement as in the details of solid construction and vigilant management. Here, therefore, we strike at once into a new field of design and invention, one that promises to be as large and fruitful as any other known to the application of electricity. There have already been several hundred patents taken out on the special subject of electric railways, and the whole air is alive with rumors of the ideas and inventions assuming shape. In a year or two it will be a wise motor that knows its own father. Each new

step is a prophecy of a dozen more. Each new patent is a "father of its country," a germ of endless fertility. We begin to learn our resources. "Is there any load that water cannot lift?" asked Emerson, "If there be, try steam; or if not that try electricity. Is there any exhausting of these means?"

Now and then I hear the objection that people would be the quicker to adopt electric locomotion if it were not so beset and made costlier by patents. This is not true, and I have no patience with the spirit that begrudges the inventor his reward. Why do we use the great inventions? Simply and solely because they effect an economy for us in some way or other, chiefly in time or money. If they did not, we should care little about them, and the inventive geniuses of the day would be mere common clay to us. But, on the contrary, the inventor is revered and admired, and is encouraged by the wealth and fame he can earn. Occasionally one hears the expression of an idea that the inventor is wanting in public spirit and devotion to science because he takes out patents and does not invite the world to revel in the riches he reveals while he is content to starve over a crust in a garret. A few weeks ago, Mr. Edison told me that he had found one of his greatest intellectual pleasures in reading "Evangeline." But why should it be less public spirited for Edison to secure a patent on his phonograph than for Longfellow to obtain a copyright on his poetry? Why should not Bell have a patent on the telephone when Victor Hugo protects his "Notre Dame?" Is it not as right for George Westinghouse to derive a princely income from his life-saving air-brake as for Gilbert and Sullivan from their comic operas? Shall not Elihu Thomson enjoy some revenue from his new art of electric welding, as well as Bronson Howard from his "Shenandoah?" It is time that the ideas on this subject were set in the right perspective. Our inventors enjoy the benefits of the patent system because, like the novelists, the poets, the musicians and the artists, they are public benefactors. They promote the public welfare, add to the public comfort, increase the public wealth. The field of electric locomotion will be but one more opportunity to demonstrate this truth. There is no patent on the horse, but the patented electric motor can beat him on every point every day in the week.

Such then, are some of the reflections to which our subject invites us, at this early stage of its development, and there is but one other point to which after this section, I shall refer in closing. Before I leave the electric street railway, I would again say as I said at the outset, that I am not presenting this latest application of electricity as perfect. It is not; on the contrary it is in development and improvement under our very eyes. It is endeavoring to harmonize with its environment. The questions and problems that it opens up are very much like the concentric shells of the Chinese ivory puzzle balls; and we have not yet reached their core. It has one or two family quarrels on hand. The telephone is hardly yet on speaking terms with it. But we know fairly well where the solution of each difficulty lies, and we are on the way to it. Nor am I in any sense an apologist for the shortcomings of our pioneer work. Electric railroad men have made mistakes,



are making them now. That cannot be helped. Heaven save us from the men who cannot make mistakes ; they will never learn. The conditions in electricity as an industry change with lightning rapidity. A Russian general once remarked of the political situation in Central Asia, that it changed every minute ; and so it is in regard to the onrush and uplift of electrical discovery and enterprise. This very fact explains why much of the earlier electric railway work has been of an unfinished, unkempt kind. Mr. Charles Francis Adams, some years ago, in his interesting little work on railroads, said :—"It is a matter of curious observation that almost uniformly those early railroad builders made grave blunders, whenever they tried to do their work peculiarly well ; they almost invariably had afterwards to undo it." This is not an excuse, however, for slovenly work. It is better to make blunders trying to do well than in lazily neglecting one's duty ; and though it hurts a man who built for eternity to see his work ripped out in five years, he has the serene, sustaining consciousness of right effort and honorable performance. The electric street railway will the sooner achieve its social destiny if the engineering done upon it be the highest and best that the art at each instant will allow.

The topic I have reserved for brief final mention is that of electrical long-distance travel. This is the department of the subject in which imagination has not yet sobered down into invention. Our fancy still plays around the possibilities, and so far from realizing the social side of teletravel, people have not yet awakened generally to the idea that it has any serious, practical side at all. Our patriarchial poet, Whittier, expressed his surprise a month or two ago in his "Burning Driftwood," when he wrote :—

"Far more than all I dared to dream,  
Unsought before my door I see ;  
On wings of fire and steeds of steam  
The world's great wonders come to me."

The steeds of steam are now an old familiar story ; but the mechanical Jay-Eye-Sees of the coming day bid fair to be those with "wings of fire ;" and then our speed may be something more nearly approximating that of light. It is amusing, however, to see how quickly our generation has become accustomed to teletravel. Did not the Royal College of Bavarian Doctors seek to forbid railway travel because it would induce *delirium furiosum* among the passengers, and drive the spectators crazy ? Did not an English quarterly say : "We would as soon expect the people of Woolwich to suffer themselves to be fired from one of Congreve's rockets as to trust themselves to the mercy of a machine going at the rate of twelve miles per hour ?" And did not our own General Webb in 1835, after a railroad journey, with ladies, from Boston to Providence, exclaim in horror : "To restore herself to her caste, let a lady move in select company at five miles an hour, and take her meals in comfort at a decent inn." Such alarming and conservative extracts have a familiar sound, perhaps, but I can assure you that they are positively of the ancient date mentioned and not extracts from recent New



York newspapers. The fact remains that to-day we have ceased to regard a speed of 60 miles an hour in railway travel as extraordinary, and are casting about for the means with which to attain a higher rate even than 75 miles, of which record was made in 1886, on a short run. This acceleration is, it appears probable, to be found best, or only, in the use of electricity, for the reason that the electric motor may drive directly on the axles, that it need not offer much resistance to the air, or smash the track, and that it does not have to carry its own supply of fuel and water. There are men in this audience who have seen such an electric locomotive making with ease 120 miles an hour, and who propose to propel it at 180 miles an hour. If these things be so—as they are—we know that with electric teletravel, the public will have to accustom itself to strange new conditions, exceeding in scope and power those of the last fifty years. The change will come in our time, and the present telegraphic and telephonic facilities are but an education for it. When we can talk instantaneously with friends in Boston or Philadelphia over a wire, we resent the inadequacy of the means of fast and far locomotion that should enable us to meet them face to face if we wish to do so. When we see electric cars in our streets traveling easily at 15 and 20 miles an hour, and know that on a clear, unbroken, straightaway track we could go from New York to Philadelphia or Boston with the same agency and kindred apparatus, in about an hour, American ingenuity and enterprise will not rest until the thing is done. That will be the first stage in the next evolution of travel.

At the present time electric street railroads are running or building in nearly 150 of our towns and cities, with some 2,000 cars on about 1,200 miles of track. So far as urban traffic is concerned, the new departure has been made. Electric locomotion is with us, an assured fact, the most civilized form of travel, as the electric light is of illumination and the telegraph or telephone is of communication. Already over 150,000,000 nickel ballots are being cast yearly in its favor, and the welcome to it is universal. In the northwest that brand-new cable plant costing \$400,000 has just been thrown aside to make room for it. In the south, it is saluted with the exclamation of the delighted darkey,—“First dey freed de negro, and now dey freed de mule.” In New York we are waiting on Providence and the aldermen, but we shall not be satisfied till this city is abreast of other progressive communities in the adoption of that which has given, in so short a time, so many proofs of its ability to promote in every respect the highest social welfare of the citizen.

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The address was followed by the exhibition, with the aid of the magic lantern, of over 50 views of electric roads in as many American towns and cities, and of the leading systems. These views were explained with running comment.

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